

Inventory and Monitoring Pacific Island Network (PACN)

Water Quality Protocol

Marine Version

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Monitoring Questions and Objectives

Question #1: What are the ranges and variances of the network water quality parameters within selected water bodies?

Objective #1: To determine temporal (events, diurnal, seasonal, annual, decadal) and spatial trends for temperature, pH, conductivity and dissolved oxygen in marine, brackish and freshwater bodies within the 11 Pacific Island Network (PACN) parks.

Justification: The range of values and their variance for each parameter must be known for the appropriate water bodies (e.g. anchialine pools in KAHO) to assess water quality in parks. Pacific island water resource types can exhibit a high degree of spatial variability and range must be determined. In addition to the NPS core parameters, chlorophyll *a*, PAR, turbidity, and nutrients are needed to evaluate water clarity and nitrification in marine water, wetlands, anchialine pools, lakes, rivers and streams.

Monitoring Questions and Objectives

Question #2: What are the temporal and spatial trends of the network core water quality parameters for individual water bodies or water resource types in each park?

Objective #2: Determine the temporal (events, diurnal, season, annual, decadal) and spatial trends for temperature, pH, conductivity, and dissolved oxygen in coastal marine waters, streams, sub-alpine lakes, rivers, and wetlands in the 11 PACN parks. If necessary, collect and analyze pilot field data to resolve knowledge gaps.

Justification: In order to utilize water quality time series data to identify temporal and spatial trends, the variability for each parameter over time and space must be known. Range and variability of the water quality parameters may correlate with temporal patterns of drivers and stressors and therefore will be necessary to evaluate changes in other ecosystem components. Temporal trends will not be identified for all parameters at all scales, rather a subset will be identified based on known and expected parameter variability and relevance to resource condition.

Pacific Island Network Parks

PACN parks where protocol is implemented

Hawaii:

ALKA- Alakahakai National Historic Trail (Big Island)

PUHO- Pu'ukohola Heiau National Historic Site

PUHE- Pu'uhonua o Honaunau National Historical Park

KAHO- Kaloko-Honokohau National Historical Park

HALE- Haleakala National Park (Maui)

KALA- Kalaupapa National Historical Park (Molokai)

Mariana Islands:

WAPA- War in the Pacific National Historical Park (Guam)

AMME- American Memorial (Saipan, C.N. Mariana Islands)

American Samoa:

NPSA- National Park of American Samoa

Field Crew

Two field crew are involved in field work, primarily for safety reasons, but also for logistical reasons in carrying out water samples.

One crew member is a water quality sampling trained biotech or ecologist, the other is park staff, interagency cooperator, CESU cooperator, or other I&M biotech/ecologist.

Field crew are drawn from biotech positions carrying out other aquatic monitoring duties and from local park staff.

Training for field crew is necessary and includes:

1. Training in the operation and maintenance of sampling instruments
2. Familiarity with all aspects of the Water Quality Monitoring Protocol
3. Experience identifying field sites and locating instrument deployment
4. Safety training

Water Quality Protocol

Four random and four fixed sampling stations were selected for in each water resource type in each park quarterly.

- Random points are used to evaluate the current status of the resource while
- Fixed points are used to determine trends in the quality of that resource.

Each of the parks will be sampled quarterly

| Parks | Strata | Sampling Interval | Sites | Staff | Fieldwork (per year) |
|-------|--------------------|-------------------|-------|-------|----------------------|
| AMME | Freshwater | quarterly | 8 | 2 | 6 days |
| WAPA | Freshwater/Marine | quarterly | 16 | 2 | 24 days |
| NPSA | Freshwater/Marine | quarterly | 16 | 2 | 24 days |
| KALA | FW/Marine/Brackish | quarterly | 17 | 2 | 24 days |
| HALE | Freshwater | quarterly | 8 | 2 | 24 days |
| KAHO | Marine/Brackish | quarterly | 20 | 2 | 24 days |
| PUHE | Brackish | quarterly | 3* | 2 | 6 days |
| PUHO | Brackish | quarterly | 6* | 2 | 6 days |
| HAVO | Brackish | annually | 8 | 2 | 12 days |

*indicates a total census of the park water bodies

Protocols for groundwater, freshwater animal communities, benthic marine and marine fish will be co-located with the sampling sites for this protocol.

Water Quality Sampling

Deployed instruments will measure

- pH
- temperature
- dissolved oxygen (D.O.)
- turbidity
- salinity/conductivity
- chlorophyll

Water samples will be collected for nutrient analysis (TN, TP, and NO₃).

Digital photographs are taken to document environmental conditions at the time of sample collection.

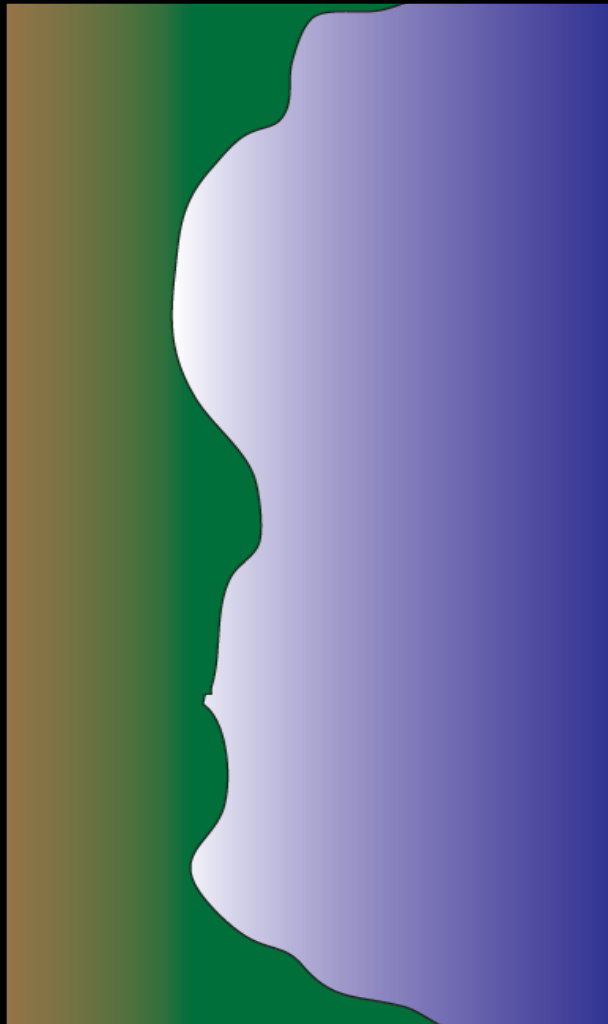
Extended deployment of the sampling instruments allows for simultaneous collection of continuous parameter measurements and point samples.

- * To allow for comparisons between the two sets of data
- * To provide a quality control comparison between the instruments.

Field Operations

- Three replicate water samples are collected from randomly chosen sites within each location (in the marine world this includes depth)
- Data logger log for 5 minutes
- Environmental data is collected

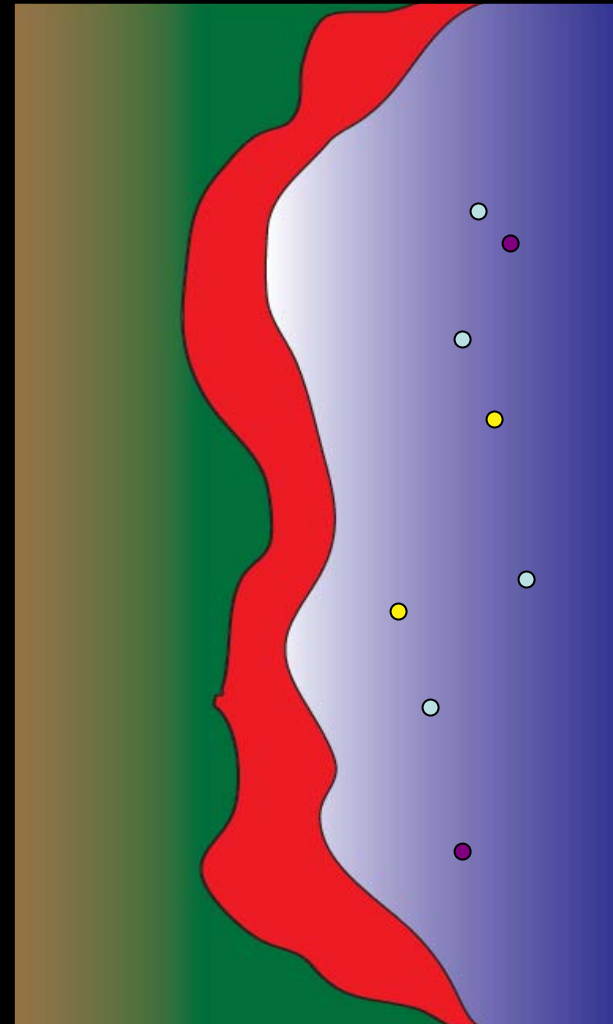
How does it look?



Park Boundaries



Eliminate unsafe
zones



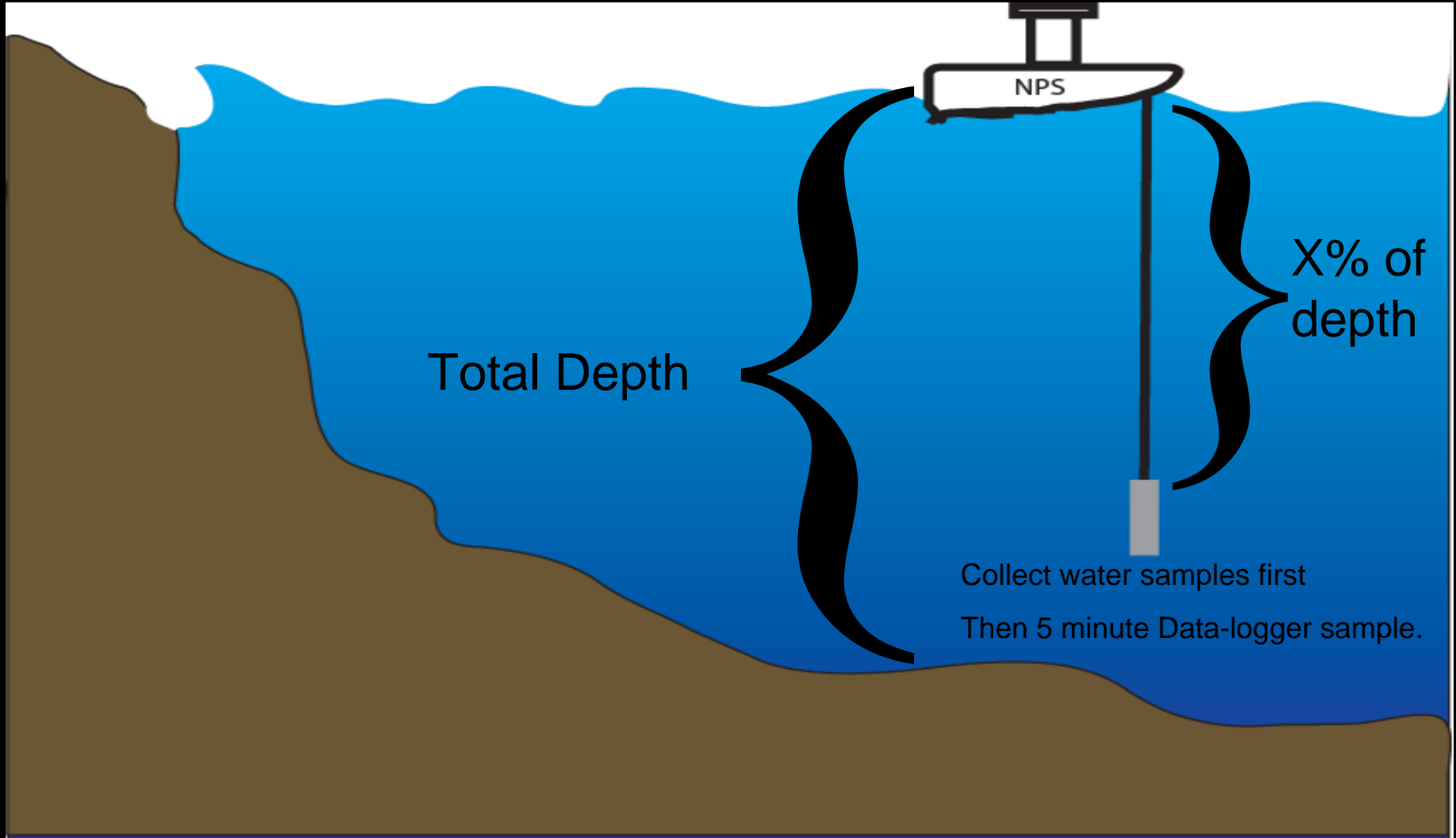
Blue is sampling area

Light Blue
Dots are
random
sampling
points

Yellow
Dots are
fixed
sampling
points

Purple Dots
are fixed
sampling
points that
also have
extended
deployments

How does it work?



Why extended and point samples?

- Long term extended deployments get at the question of daily and monthly variations.
- By collecting simultaneously with a point collection data logger log we are able to correct for sampling time differences

(i.e. oxygen levels change as you move from site to site, but by using multiple loggers we are able to correct for the differences.)